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ABSTRACT

The computerization of the campus has had a profound effect upon the way in which students, faculty, and administrators work and interact with each other. The purpose of this report is to update the findings of an ongoing study of unexpected changes in human interactions precipitated by the introduction of easily accessible computing in the academic workplace. This paper attempts to integrate earlier studies of this topic with an ongoing study of the effects of microcomputer usage on the productivity of academic scientists, together with anecdotal reports on the subject. Observations and anecdotes are discussed and categorized in terms of a computer usage outcomes matrix. The matrix distinguishes the types of social impacts of computing at three levels--the individual, organizational, and extra-organizational. The other axis of the matrix categorizes computing activities, tools and procedures into six groups: career/personal, databases, data/file maintenance, networking/electronic mail, security and control, and word processing/graphics. The result is a matrix of changes in behavior; each cell in this matrix is discussed. In addition, implications and suggestions for planning and management are discussed. (Author/KM)

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PLANNING FOR THE SOCIAL DISRUPTION OF THE MICROCOMPUTER REVOLUTION IN ACADEME

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Planning for the Social Disruption

of the Microcomputer Revolution in Academe

Abstract

The computerization of the campus has had a profound effect upon the way in which students, faculty, and administrators work and interact with each other. The purpose of the paper is to update the findings of an ongoing study of unexpected changes in human interactions precipitated by the introduction of easily accessible computing in the academic workplace. In addition, implications and practical suggestions for planning and management are discussed.

Introduction

The introduction of computers, particularly personal computers or PC's, into the academic work environment has reached a fever pitch in the second half of the 1980's. Despite this widespread integration of computing and the regular activities of academe, relatively little has been written as to how this process has changed the campus environment in ways that were not initially planned. Completed, but as yet generally unpublished, studies at several universities, as well as a number of anecdotal incidents offered by colleagues, have revealed some interesting ways in which computer usage has changed people's lives. Technological change has led to social change (the "side effects" of technology) almost without notice by those most directly involved. The following is an update of the results of a previously reported and ongoing study of the unplanned

outcomes of computer usage. It also attempts to offer practical ways in which such outcomes can be anticipated and planned for.

Literature Review

Surprisingly little has been written concerning the sociological and social-psychological impact of computer usage on modern society. Two works have focused on specific subtopics within the broader subject, however. Hill, Camden, and Clair (1986) have described the reactions of one group of faculty members to the introduction of computer terminals into a single academic department. Snizek (1987) reported some of the results of microcomputer usage among scientists at two universities, with a focus on how such usage has impacted professional productivity. Fleit (1987) described the "Seven Great Myths of Computing," which are perpetrated by computing professionals, and has stated succinctly the management challenge: "The important revolution in higher education will happen in the human arena, not in the technological one" (p. 8).

One attempt has been made to gather together a collection of observations regarding the impacts of computer usage (Muffo and Conner, 1987). This paper, however, makes no attempt to consider how academic and computing managers might plan for the kinds of impacts not widely discussed in the literature previously.

One of the best theoretical backgrounds for discussing discontinuous, disruptive innovations such as the introduction of computers into the workplace is provided by social scientists who have examined the innovation process. One of the classic works in this area is that of Rogers (1983). A more specific analysis of computing as a discontinuous innovation is offered by Simon (1987). Beginning with the proposition that computers have triggered a second industrial revolution, Simon suggests that the introduction of minicomputers and microcomputers has brought us into the third generation of this second industrial revolution (p. 3). He notes, however, that the pace of change

from one generation to another is much quicker now than that of the earlier periods of history.

Methodology

The earlier study (Muffo and Conner, 1987) drew heavily on the work of Camden and Clair (1986) for observations concerning unanticipated outcomes of widespread computer usage in academe. In addition, a number of other observations were drawn from personal experiences of the authors and colleagues, as well as a smattering of examples from other literature sources. This paper attempts to integrate the earlier work with that of Snizek (1987), who, with financial support from the National Science Foundation, is continuing to study the effects of microcomputer usage on the productivity of academic scientists. Other anecdotal reports offered by a wide variety of colleagues are incorporated in this effort as well.

A difficult task in pulling together all the observations and anecdotes is determining some way of structuring and organizing the information. One attempt to do this can be found in Table 1, which distinguishes the types of social impacts of computing at three levels: the individual, organizational, and extra-organizational levels. Here the individual level pertains mainly to effects on a single person, while organizational refers to a larger group such as a department, college, or institution. Extra-organizational refers to relationships beyond the immediate environment, such as the college or university, and involves the larger geographic, personal, and social community, as well as the disciplinary community of scholars. The social impacts may be positive, negative, or neutral in terms of the effects on the levels involved. Often there is potential overlap and disagreement as to whether an effect is positive or negative, for example, or whether or not the primary level impacted is the individual or the organization.

----------Insert Table 1 About Here----------

Along the Y-axis in Table 1 lie the subject areas involving the effects of computing activities, tools, and procedures on the way students, faculty, and administrators conduct their personal and professional lives. The effects of these computing-related topics can occur at either the individual, organizational, or extra-organizational levels. The result then is a matrix of changes in behavior, most often unplanned and unanticipated, precipitated by the introduction of relatively accessible and inexpensive computing resources into an academic or administrative unit in an institution of higher education.

Results

The Computer Usage Outcomes Matrix makes it possible to categorize a widely disparate set of examples into a more logical set, as is demonstrated by the following examples.

Career/Personal — Individual Level

- Strong personal involvement is a term often used to describe individual reactions to the introduction of computing as an accessible research and administrative tool. On the negative side, frustration is commonly mentioned. On the positive side, personal satisfaction, control over one's work, and the excitement of using a new, powerful tool are expressed. Commitment to overcoming technical and other barriers is necessary in order achieve a reasonable level of expertise.

- Some faculty members and others have become so involved in computing that they have abandoned the careers for which they were initially trained in order to work in the computing field full-time. An example would be a chemistry professor who resigns his faculty position in order to write computer software unrelated to chemistry.

- There are documented instances where the use of personal computers has led to reduced productivity among scientists and other academics. The temptation to experiment and play with the computer can sometimes serve as a time consuming distraction from one's basic work.

- There is concern that heavy dependence on computational methods may lead to greater emphasis in academic research on the quantifiable, to the detriment of qualitative and other, less quantitative methodologies. Good research should always allow for shades of gray as well as black and white.

- The availability of computing has led some faculty to expect larger sample sizes to be used in the research projects of colleagues and students, particularly doctoral students. Other standards are supposedly tightening as well. For example, some contend that the numbers of re-writes of dissertations required by faculty have increased as word processing capabilities have become more common. Students are expecting greater accuracy of faculty also.

- New technology can lead to occasional role reversals. Junior colleagues, support staff, and students have been known to help senior faculty and administrators to learn to use computing resources. Often senior people are reluctant to seek such help from subordinates.

- Evaluation issues which commonly arise in discussions of other types of learning apply to the use of computers as well. Ceiling effects, for example, have been observed when individuals already knowledgeable regarding computing have been offered easy access to PC's or terminals in the workplace, while substantial learning was taking place among the computer neophytes in the same department or institution.

- Being the departmental microcomputer expert has been shown in some cases to be detrimental to a graduate student's chances of ever being granted the degree for which he or she is studying. Faculty and staff become so dependent on the student's expertise that they are unwilling to let the person graduate and move on in a traditional career path.

Career/Personal — Organizational Level

- The easy availability of computing resources and expertise has become a retention issue for both faculty and students. Some students have been drawn to attend specific institutions of higher education because of their reputation for computing. Faculty who have become dependent on personal computers or terminals connected to mainframes in doing their routine academic work have threatened to leave the employing institution if the access to computing were removed or declined in availability.

- Promotion and tenure procedures for faculty often don't reward a faculty member for spending time on computing-related projects instead of more traditional research and teaching activities. Even in the instance where only traditional teaching and research are evaluated, however, the faculty member who has a working knowledge of computers for word and data processing has the competitive edge over who does not, for efficiency reasons if for no others.

- A long-standing professional barrier for computing professionals has been their tendency, due to training and often natural personal inclinations, to have difficulties communicating with computing nonprofessionals. Given the decentralization of computing functions in most major organizations, including institutions of higher education, computing professionals are going to be required to interact even more with faculty and other staff than they did in the past. Personal interaction skills are currently gaining in importance as compared to technical skills.

Career/Personal — Extra-Organizational Level

- Computing expertise has made it easier in some cases for faculty and staff to move from academe into industry and back. While such mobility between institutions has been common in the past, and while the occupational interaction between academic life and industry has been observed often in certain applied disciplines, the development of computer expertise has led to a wider variety of academics and their disciplines being represented among the inter-sector transfers.

- The impact of computing on personal lifestyles has gone beyond the workplace and into the home. Stories of computing enthusiasts ignoring their families in order to work or play on a personal computer have become common. Several divorces due in part to excessive computer usage by a spouse have been documented.

Databases — Individual Level

- Accessibility of databases is a tremendous convenience for researchers, but it can also lead quickly to information overload. The importance of gathering one's own data, while not eliminated entirely, is reduced in importance. On the other hand, it has become more critical to perform such activities as data selection and critical analysis. Expert systems tools can aid in these efforts, but individual judgment will remain as the key ingredient for success.

Databases — Organizational Level

- Decentralized computing has resulted in stronger pressures to make raw data available to a greater number of users. This situation can present substantial challenges to those responsible for maintaining the integrity of the data and the results, since virtually all databases have specific idiosyncrasies that are often not well understood by the potential users. In other words, simply allowing easy access to raw data does not mean that the results of manipulating those data will be consistent across all users. Disparate answers to the same question can be expected in such circumstances, resulting in a low level of user satisfaction. Interactive expert systems may be one approach to alleviating this problem.

Databases — Extra-Organizational Level

- The availability of easily accessible databases exerts an influence on what kinds of phenomena are studied and the ways in which they are studied. Research questions are sometimes framed in light of the data already available, rather than the data being the product of research growing out of an earlier question. Manipulation of existing data without a research agenda is also a temptation. There is a danger that those outside of a profession may be setting the agenda for the research questions of that profession by collecting data and making it widely available, for whatever original purpose.

Data/File Maintenance — Individual Level

- Direct physical control over one's data is seen as desirable by a number of different kinds of individuals. Professionals are more likely to try simulations and other processes where the risk of a wrong or silly result is high if nobody else, such as a programmer, is involved. They also don't have to worry about a potential competitor discovering their strategies through an intermediary.

Data/File Maintenance — Organizational Level

- The widespread use of personal computers has led to a problem of data currency in organizations. When data are downloaded from a live database, they are essentially frozen in time. Changes continue to occur in the database, but are not captured in the file on the personal computer. The benefits of the ease of manipulation and control gained by downloading the data may quickly be overcome by the lack of currency of the results.

Data/File Maintenance — Extra-Organizational Level

- A common, but difficult and complex, problem of data/file maintenance at the extra-organizational level is making the data shared with others understandable as well as accessible. While the user of another's data has an obligation to learn as much as possible about how the data were gathered and what special features one should be aware of, a deeper understanding of the data complexities are impossible without thorough documentation on the part of the owner of the data. Many research efforts go awry because the data user does not understand that inactive files

were included in the database, that multiple sites and/or time periods were involved, that values outside of specific ranges were included, etc.

Networking/Electronic Mail — Individual Level

- For students, the computer laboratory has become a new social center of campus, not unlike the student union. Stories of friendships and even romances growing out of personal encounters in the computer labs and through electronic mail are common.
- Sending humorous notes and sharing jokes and funny stories seems to be a common occurrence among frequent users of electronic mail networks.
- Electronic mail can become a novelty or a type of game which takes time and effort away from more central pursuits.
- There is an increased risk of misunderstanding inherent in the use of electronic mail, since there are no audio or visual nuances available to the recipient. Some have called electronic mail a "cold" medium due to its restrictive, written nature, but many more have argued that the results are often "hot." Message recipients may get angry due to misinterpreting something that has been sent. In addition, emotional notes are more easily sent via electronic mail than if one had to wait for them to be typed by a third party, thereby providing a cooling-off period. Some generally incompatible parties how found, however, that electronic mail is the only way that they can communicate with each other.

Networking/Electronic Mail — Organizational Level

- Human interaction across administrative and geographic boundaries is encouraged by electronic mail, since distance and reporting responsibilities are transparent to the users involved. This can lead to a realignment of collegial relationships within a department or institution. The sharing of information regarding the uses of computing can alleviate barriers among faculty with different disciplinary and specialty interests, for example, even when those involved have offices in different buildings or on separate campuses. The reverse of this is that faculty who formerly shared disciplinary interests with each other might well drift apart if their interest in computing is not shared evenly.
- Faculty-student interaction can be enhanced through the use of electronic mail for distributing assignments, announcements, progress reports, questionnaires, etc. The major advantages include less paperwork and better access to all involved. On the negative side, class attendance may be lowered when essential information is available through this alternative mechanism, thus reducing the amount of classroom interaction and feedback which is an integral part of the learning process.
- Busy users of electronic mail sometimes purposely avoid reading the mail when they don't want to have to respond to every item coming through the network. This is particularly likely to happen if assistants and support staff are not part of the network, since it is easier to pass along letters, memoranda, and other written documents in such cases than it is to print and then forward often incomplete electronic messages.

Networking/Electronic Mail — Extra-Organizational Level

- Geographic, time, and even some of the linguistic differences among disciplinary colleagues are reduced by convenient and relatively inexpensive electronic mail communication among institutions of higher educational nationally and worldwide. Increased communication among those with common disciplinary interests is an

inevitable result, but this situation may also lead to decreased communication with colleagues in closer geographic proximity who do not share most of one's disciplinary interests. Interdisciplinary collaboration within one's own institution may well suffer. "Psychological distance," rather than physical distance, is becoming a more critical factor in academic life than it has been in the past. Those not using the new communications technology risk being excluded from the newly developing communications channels.

- Cross-institutional and cross-national professional interaction often leads to personal friendships among those involved. Not only do faculty and staff come together through common interests, but even the support staff involved in the communications develop personal relationships. As an example, a secretary from an American university spent part of her summer vacation in Maine with a secretary from an Austrian university. They had met through BITNET/EARN when working on scholarly manuscripts being produced through the collaborative efforts of their respective faculty. Their first personal meeting was on the initial day of the joint vacation.

- A major benefit of electronic mail over long distances is its time independence. One can convey messages over several time zones without being required to be concerned about the time of day at the receiving point, let alone whether the person for whom the message is intended is at the reception point at the time that the message is sent. Communication over long distances thus becomes more convenient and efficient, combining the immediacy of the telephone call with the relative convenience of the written letter.

- Large, interconnected electronic mail networks provide the means to send messages to a large number of individuals at one time. Concern has been raised among users as to possible abuse of the networks through electronic junk mail, i.e., messages of little or no interest to most of the recipients.

Security and Control — Individual Level

- Data security tends to be less of an issue in higher education than in some other fields, but it remains an issue nonetheless. Faculty normally have some concern about research data, but more about the security of student grades and tests. Personal computer usage can help alleviate some of the fears related to the classroom, but in some cases it is substantially more difficult to communicate with institutional mainframe facilities when using a PC. In addition, faculty, administrators, and staff often have to purchase the personal computers partially or wholly from personal funds, and continue maintaining the equipment from these same sources.

Security and Control — Organizational Level

- With the advent of decentralized computing, the organizational temptation is to push the cost of computing down to the operating unit level (i.e., college and department). Besides the purchase of equipment, a major expense is the maintenance of computing equipment which has already been purchased, as well as the paper and other supplies necessary to use it. Most expensive of all is the training and consulting time necessary to enable students, faculty, and staff to use the equipment in a productive manner.

- Decentralized computing leads to situation where there is an ongoing, natural tension between the centralized computer center and the operating units. A prime example of this is the computer laboratory, which may be located in an academic, administrative, or student housing unit. In general, computer centers would prefer

to shift the substantial expense of operating the computer laboratories onto departments and colleges. Even in cases where this occurs, however, the technical and policy issues regarding terminal-mainframe interaction continue to require attention.

- Concern about data security has a long and ongoing history in computing, as does concern over possible mainframe failure. With the advent of decentralized computing, planning for both kinds of security becomes more complicated and dispersed. A personal computer can go out of service, for example, causing inconvenience to an individual but not to a larger group. On the other hand, destruction of a major cable or switching point might cause substantial inconvenience to a large number of people, but leave individuals primarily using personal computers virtually untouched. Not only do those in charge of central computing facilities need to plan for the loss of computing resources, but those managing academic and administrative unit computing, as well as individuals, also need to plan for the possibility of a major disruption in computing services.

Security and Control — Extra-Organizational Level

- The traditional main external concern regarding security has been that of outsiders gaining access to organizational data; the term "hacker" is often used to describe such unauthorized access. Electronic mail has introduced another aspect of the security issue. As the Iran-Contra hearings have demonstrated, mainframe computer back-ups of electronic messages are frequently maintained without full understanding by those using the system. These can be utilized by others beyond one's immediate organization under certain circumstances, to the detriment of both the senders and receivers of the messages.

- Whether or not to require students to purchase personal computers is an issue with ramifications beyond the institution of higher education involved. The college or university sees economic benefits to shifting computing costs onto the students, while at the same time having the institution convey a modern, high tech image to the world beyond the campus. This type of policy is not without its drawbacks, however. The impact of computer usage is not well understood at this point, nor is it known whether the positive publicity of the high tech image outweighs the loss of prospective students due to increased costs and that same high tech image. Inexpensive and usable software remains a rare commodity in many academic disciplines, and the institution must still support the presence of a large number of personal computers on campus as to mainframe access and increased electrical power requirements.

Word Processing/Graphics — Individual Level

- The increased efficiency and flexibility provided by easy access to word processing is sometimes offset by personality quirks of individual users. One example is the scientist whose publication rate has declined since he began using word processing due to a lack of closure on research papers. In the past, he simply turned a final version of a paper over to a secretary, telling her to mail it out when all corrections were incorporated into the paper. Now he constantly revises the paper on his personal computer and seldom reaches the point at which he is able to put the finish product in the mail himself.

- The availability of word processing enables individuals to exercise total control over the production of their written work. This is particularly important to those working on sensitive topics that they would prefer not to share with support staff. It is also seen as an advantage by those who are naturally suspicious.

- Improvements in word processing and graphics software have made it much easier to present information in visually attractive ways. One consequence is the growing inclination to substitute "warm" presentations of information that, in the past, would have been represented by "cold" written text or data.

- The frequent use of word processing software can lead to an over-dependence on computing. Such flaws as word and grammar misuse are not normally highlighted by such software, yet they still detract from the readability of one's communications. In other words, those using word processing software must constantly be alert to the fact that not having a spelling error in a memo, letter, report, or paper does not mean necessarily that further editing is not required. The advent of desktop publishing makes such an admonition even more pertinent.

Word Processing/Graphics — Organizational Level

- The relationship between professional staff, such as faculty and administrators, and support staff, such as secretaries, has changed with the advent of word processing. It is not unusual for faculty to draft papers on a personal computer, leaving little or no intervention necessary on the part of support staff. Some secretaries have been reported to be purposely slowing down their typing of professional work in order to encourage faculty to do even more themselves. Such behavior will probably lead to fewer support staff being necessary in such units. On the other hand, professional staff may end up performing more routine chores that could be done more inexpensively by support staff.

- The introduction of desktop publishing has made it much easier to produce professional looking published materials. A danger in this is that the publication production process also requires a high level of knowledge and experience regarding communication flow and other areas of communications as a field of study. Hence what initially appears to be slick and professional ends up looking amateurish and poorly done on closer inspection. Printing professionals are therefore shifting their roles from being producers of publications to being consultants regarding the production of publications.

- Faculty have reported using different criteria in correcting papers submitted in printed form if they have been written with the aid of word processing software, due to the relative ease of producing a final, edited paper. The result is a double standard for evaluating students' work, one for those with access to word processing and another for the rest of the students in a class.

Word Processing/Graphics — Extra-Organizational Level

- Extensive use of word processing and graphics software to produce routine written correspondence requires a different sort of individual to perform these tasks than in the past. Training of support staff requires some familiarity with computers nowadays, in addition to the more traditional typing skills. These people must also be flexible enough to learn different types of systems and be able and willing to update their knowledge on a periodic basis. Such skills require more than the satisfaction with routine that was traditionally expected of support staff in the past. Some continuing employees may have difficulty adjusting to the new environment. Certainly hiring and training procedures in all organizations will have to adjust to the new realities at a time of declining numbers and quality of high school graduates from among whose ranks support staff are most often drawn.

Planning

Any planning process for the implementation of convenient access to computing must be done in a thorough and sensitive manner. The need to plan will not be intuitively obvious to most of the parties involved, and resentment could easily result. Lack of planning, however, can lead to many of the kinds of problems documented above. Using the Computer Usage Outcomes Matrix as a structural guide, it should be possible to develop some general principles addressing the social effects of the micro-computer revolution.

Career/Personal Planning

How one works is inevitably affected by the introduction of accessible computing, unless the tool is ignored by the individual and colleagues alike. The manner in which subjects are approached, the topics studied, the methodologies used to gather and analyze data, and many other aspects of working life will be changed. It would ease the transition substantially if these matters were discussed with those involved before the introduction of technology, and periodically during the early stages of its introduction.

Hill *et al* (1986) found that some faculty reacted negatively to those with computer expertise within their own departments, because long-standing status relationships break down where computing expertise is involved. This suggests that the use of outside consultants (at least from outside the immediate academic or administrative unit) can be critical to the successful introduction of computing. People in academe seem to be more receptive to technical experts with little disciplinary expertise in their academic fields than to other disciplinary experts with some level of technical competence; the former are simply perceived as being less threatening professionally.

Career paths and reward systems should be specified prior to serious computer immersion. If the rules involved are to change, this should be explicit. If people are not to be rewarded for becoming computer experts, this too should be well known beforehand. Those in leadership positions should also monitor individual professional behavior and to be prepared, where necessary, to provide helpful advice and counsel to those appearing to drift too far afield.

Database Planning

No database should be made available to those not involved in gathering the data without extensive documentation being made available. This should include an overview of how the data were gathered, as well as descriptions of each data element, including the range of allowable values and any other information necessary to interpret the data correctly. This is a difficult and tedious task, and consequently is done poorly or not at all in many cases, making sound conclusions drawn from use of the database nearly impossible.

Researchers should be warned about the dangers of depending on the use of existing databases to frame research questions, since more important research issues may not be addressable using existing databases. Promotion and tenure decisions might take into account the different level of effort involved in research where original data are gathered versus research utilizing existing databases, rather than depending primarily on volume of published research in making such decisions.

Data/File Maintenance Planning

Both microcomputer and mainframe users need to prepare for the inevitable loss of original data files for whatever reason. Some training regarding this topic can save hundred or thousands of hours lost when research results are accidentally destroyed.

Additional training regarding documentation and the pros and cons of using data which are frozen in time can likewise head off potential problems.

Networking/Electronic Mail Planning

Sensitivity seems to be the watchword in this area. The advantages of electronic mail quickly become obvious to users; the subtle ways in which it affects their interpersonal relationships is another matter. The fact that one's collegial network shifts with the use of electronic mail should be pointed out early in the introduction process, to enable new users to be prepared for such changes. They should also be warned about the pitfalls of this seemingly "cold" medium which so easily lends itself to "hot" exchanges.

Security and Control Planning

The major issues here are data security and budgetary. Mainframe systems use standard security measures to protect sensitive files. Those requiring even more elaborate measures, such as some faculty for grades and examinations, might benefit from useful suggestions for additional, personal security measures *before* an embarrassing situation occurs.

The budgetary issues are more obvious, but just as complex, particularly in a unit that has purchased its own equipment. Maintenance and supply costs have to be built into the unit's budget in order to use the equipment purchased. Personnel costs must be estimated as well. Lastly, a depreciation schedule should be developed where funds are set aside each year for equipment replacement due to physical and technological obsolescence. The latter activity is particularly difficult to accomplish, and most often overlooked, when the original purchases were made with one-time, nonrecurring funds.

Word Processing/Graphics Planning

Users must be made aware that word processing and graphics software do not replace sound reasoning and careful reading in the production of manuscripts and other printed documents. They should also be alerted to the pitfall of assuming that such tasks as producing graphics are strictly mechanical and require little or no knowledge of layout, production, and related matters.

Relationships between professional and support staff should be monitored to ensure that professional staff do not end up doing that which is done more efficiently by support staff, and *vice versa.* Some reallocation of resources and changes in staff selection and training may be found to be desirable as the introduction of computing becomes routinized in the unit.

Conclusions and Implications

There are many effects of the changing technology that are not often considered by those involved, yet which often profoundly affect their lives. The paper is intended to encourage institutional researchers, as well as academic and computing managers, to reflect upon these outcomes and to plan for them. Careful planning should enable those involved in the innovation diffusion process to soften some of the effects of the innovations and to make the inevitable transition as smooth as possible.

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Table 1

Computer Usage Outcomes Matrix

TOPICS	LEVEL		
	Individual	Organizational	Extra-Organizational
Career/Personal			
Databases			
Data/File Maintenance			
Networking/Electronic Mail			
Security and Control			
Word Processing/Graphics			